PTO 04-3111

CY=EP DATE=19950719 KIND=A1
PN=663 363

LAMELLAR RING, PARTICULARLY FOR A SPREADER ROLL, AND A DEVICE FOR GUIDING WEB-LIKE MATERIAL AND METHOD FOR PRODUCING IT

[Lamellar ring, insbesondere für spreading rollers, sowie damit versehene Einrichtung zur Führung web-like Materialien und Verfahren zu deren Herstellung]

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UNITED STATES PATENT AND TRADEMARK OFFICE
Washington, D.C. May 2004

Translated by: FLS, Inc.

PUBLICATION COUNTRY	(10): EP
DOCUMENT NUMBER	(11): 663363
DOCUMENT KIND	(12): A1 (13): Application
PUBLICATION DATE	(43): 19950719
PUBLICATION DATE	(45):
APPLICATION NUMBER	(21): 94119610.7
APPLICATION DATE	(22): 19941212
ADDITION TO	(61):
INTERNATIONAL CLASSIFICATION	(51): B65H 27/00
DOMESTIC CLASSIFICATION	(52):
PRIORITY COUNTRY	(33): AT
PRIORITY NUMBER	(31): 2558/93
PRIORITY DATE	(32): 19931216
INVENTOR	(72): Koren, E.
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TITLE	(54): LAMELLAR RING, PARTICULARLY FOR A SPREADER ROLL, AND A DEVICE FOR GUIDING WEB-LIKE MATERIAL AND METHOD FOR PRODUCING IT
FOREIGN TITLE	[54A]: lamellar ring, insbesondere für spreading rollers, sowie damit versehene Einrichtung zur Führung web-like Materialien und Verfahren zu deren Herstellung

This invention relates to a lamellar ring and a device comprised of individual lamellar rings for guiding web-like materials, for example paper, textile, or foil webs and a method of producing them.

There are various types of such devices, also called spreading rollers. So-called "banana rollers" are known, which are arched like a banana, whereby the rollers are subdivided into individually deformable sections, so that the roller can be deformed when a web-like material is fed over it, forming an essentially cylindrical sectional shape on the surface section. However, this type of roller requires considerable maintenance. Additional types include rollers with a deformable broad coating, which is usually arranged with grooves at an angle to the axis, so that the coating is subdivided into individual segments which, when pressure is applied, tilt to the left and right of the roller ends. When then segments are tilted their surfaces, which in the unpressurized state are parallel to the roller axis, are tilted, so that the parallelism is lost and the roller takes on a corrugated surface. Due to the forces of adhesion, a web running over such a roller will be stretched to the two ends. The disadvantage here, however, is the irregular surface. With very thin or sensitive webs in particular, such as films or silk, imprints or creases can be caused by the grooves, so that the end product is practically worthless and must be rejected. These rollers also have disadvantages in dying, since the dye penetrates into the grooves and when the color is changed the textiles are striped with the previously used dye. It

is known for such rollers to completely lose individual segments when damaged so that they must be rebuilt, which is very difficult and expensive for the end user.

DE-A-30 16 321 reveals, among other things, a roller comprising individual annular disks that are connected to one another by rods and that can be laterally moved pressure roller. However, this design can be used only as a tape controller and for this function it requires an electrical or pneumatic control unit.

EP-A- 0 381 244 describes a spreading roller, where on the bearing core a strip in the form of a helix is wound as a covering, on the circumference of which lies a web that is to be conveyed and that is to be stretched over its width. With the helical surface, an insufficient spreading effect is produced and the grooves that are present would leave undesired traces on the surface of a web-like material running over it.

EP-A- 0 026 467 describes a spreading roller, whereby a steel tube is rotatably supported and centered on an nonrotating shaft. The design is extremely complex to make and maintain and it is costly.

The object of this invention is to eliminate the above-mentioned disadvantages and to produce a cylindrical roller with a smooth surface, without wear-prone mechanisms, that will achieve the desired spreading effects.

This invention is based on a special type of lamellar ring, which is Z-shaped in cross section and has essentially two buckling points,

whereby a defined deformation of the surface can be produced, and optionally a specially made tube for this lamellar rings with inside profiling.

The required spreading effect is achieved in that, the lamellar rings of this invention are symmetrically placed on a roller core from the central plane outward to the left and right, whereby the rings are lined up next to one another forming a nearly closed surface, so that in case of a radial application of pressure, e.g., by the tension on the material web running over it, the outer circumference shift axially and symmetrically to the axial center plane and the cylindrical surface maintains parallelism with the roller axis. In a preferred embodiment of the invention, the linings on the individual lamellar rings have different Shore hardnesses, whereby the Shore hardness can decrease from the middle to the ends of the roller. In this way, the spreading effect can be influenced in a positive manner.

Over this spreading roller made of individual rings, a flexible covering can then be applied, e.g. in tubular form with a surface and inner radial projections which engage in the spaces of the adjacent row of rings designed for this purpose. This is particularly advantageous for operation in wet regions.

The smooth surface prevents damage or drawing on even the finest material running over it. Moreover, it is easy to clean the surface of impurities, such as ink residue. This is of particular advantage for coloring in the textile and paper industries. However, the roller can

also be used to advantage in the film industry for producing magnetic tapes (video and audio) and for producing the finest aluminum foil.

With aluminum foil, in particular, a conventional roller with grooves would leave traces without fail.

To achieve the spreading effect, the projections are advantageously symmetrical to the axial central plane of the roller, whereby there is a symmetrical projection in the central plane. During the spreading process, the projection of the central plane, which is preferably rectangular, remains fixed in place, while the other projections are shifted toward the ends of the roller.

An additional embodiment of the invention is the double system, which may be used wherever no sufficiently great surface pressure can be produced over the wrapping angle and the tractive force of the web to deform the lamellar rings. In this case, two rollers made in accordance with this invention are arranged one above or beside the other, one of them being parallelly adjustable to the other. Pressing the two rollers against each other causes the lamellar rings to be deformed where the rollers are in contact, whereby at this point the surface of the rollers can be spread axially from the center toward the ends of the rollers. Thus, a web of material fed through this double system is spread continuously over the width.

This invention also relates to a method of producing a spreading roller in accordance with this invention. Here, the flexible tube, produced on a mandrel, is placed in a compression-proof pipe and the

edges of the tube are inverted around the ends of the pipe and fastened. A vacuum is then applied to a suction nozzle placed on the pipe and the air between the tube and the wall of the pipe is withdrawn, so that the tube expands in diameter and is pressed against the inside of the pipe. A roller provided with lamellar rings is then introduced and positioned in this tube, which has been expanded in diameter. Once the vacuum is turned off, the tube returns to its original diameter, whereby the inner profile is inserted into the spaces provided for this purpose on the circumference of the lamellar rings. This process prevent damage to the lamellar rings and the tube. After the roller has been removed from the pipe, the remaining tube ends on the face end of the roller are trimmed to size.

The invention will be explained in greater detail with the help of an exemplary embodiment.

The figures show:

Figure 1: schematic representation of a roller with lamellar rings having a flexible cover,

Figure 2: schematic representation of the spreading function,

Figure 3: schematic representation of the double system,

Figure 4: schematic representation of the double system's function,

Figure 5: schematic representation of a lamellar ring

Figures 5 a and 5 b: schematic representation of the production of a roller with a tube profiled on the inside,

Figure 6: representation of a roller without a covering, and

Figure 7a and figure 7b: cross sections of additional variations of lamellar rings.

Figure 1 shows a section of the roller of this invention. It includes a roller core (1), which is usually made of metal, in particular steel. On it are lamellar rings (2), which extend outward from the center to the left and right, arranged in the opposite sense. On their outer circumference, lamellar rings (2) are made in such a way that at the surfaces between the individual rings that are in contact an intermediate space (9) is formed that is basically triangular in shape (see Detail Z). These intermediate spaces (9) run radially to the axis of lamellar rings (2). Flexible tube (3) with inside profiling is placed on lamellar rings (2). The inside projections (10) engage in intermediate spaces (9). Projection (11) lies in the central plane of the roller and fixes tube (3) in position. Section A-A shows the structure of the roller in cross section.

In Detail Z, the Z-shape of the lamellar rings with buckling points (4) and (14) may be seen.

The spreading function of the roller is shown in Fig. 2. The wrapping and tension of web (5) produces a surface pressure (4) on the surface of the roller, which is formed by flexible covering (3), whereby from the central plane outward in the opposite sense, lamellar rings (2) bend axially outward. This deflection of lamellar rings (2)

from the middle outward and to the right and left in the direction of arrows (12) is transferred to tube (3), with its inside profile. The web is spread in the axial direction by the friction lock between web (5) and the surface of tube (3). In this way, preexisting creases are removed and crease formation prevented. Due to the rotational motion (13) of roller (1), after leaving contact surface (7) the lamellas of lamellar rings (2) right themselves once again and the roller surface shrinks in this region to its manufactured length. This process continues constantly, as long as the roller is driven by the web. Corresponding rings are shrunk or glued to the ends of the roller, in order to fix lamellar rings (2) onto roller core (1). Thus, a roller core with a smooth surface can be used as the base article.

Figures 3 and 4 show schematic representations of the double system and its operation. In this case, depending on the line setup, two rollers of the system described above are arranged one above or beside the other, whereby one of the two rollers can be mechanically lifted or pressed against the other. Due to the linear pressure caused when they are pressed together, lamellar rings (2) under profiled tube (3) are directed axially from the center outward to the left and right, i.e. toward the ends of the rollers, whereby tube (3) of the two rollers (1) is extended axially and web (5) in between is extended in width. By changing linear pressure (8), it is possible to increase or decrease the spreading effect.

Under Fig. 5 a section of an individual lamellar ring (2) is shown in the unpressurized and the pressurized states. In order to maintain the parallelism with the center axis of the pressure, lamellar ring (2) is provided with two buckling points (4) and (14).

When pressure is applied, the outer cylindrical circumference (20) of lamellar rings (2) is pressed downward by the distance dx, while at the same time there is an axial displacement of dli.

Figures 5 a and 5 b show the device used to produce a roller S in accordance with this invention. The device contains a pipe (15) with an air connection (16). Flexible covering (3) is inserted into the pipe, inverted at the ends, and affixed to pipe (15), e.g. with hose clamps (18). By applying a vacuum to air connection (16) in direction (17), covering (3) is sucked onto the inside of the pipe and expanded. Then a conventional spreading roller (1) is inserted into the pipe in the axial direction and positioned. Subsequently, the pressure can be equalized in direction (19), whereupon flexible covering (3) is firmly applied to roller (1). After clamps (18) are released, the finished device is removed from pipe (15) and the excess covering (3) removed. In principle, the flexible covering can also be pressed against the inside of the pipe by compressed air on the inside, restoring normal pressure once roller (1) has been inserted, so that in this case the covering is also pressed against the roller.

Figure 6 shows a roller design without a tube on the outside, whereby the individual lamellar rings have a rib with parallel edges.

At the center of the roller there are two specially shaped lamellar rings, having a surface that is extended toward the center of the roller. An individual ring of this kind is shown in figure 7 a. Figure 7 b shows a section through a lamellar ring, with a rib expanded toward the axis.

This invention is not limited by the examples shown, but other types of lamellar rings can be used, whereby the parallelism of the surface under pressure is retained.

1. A lamellar ring, in particular for spreading rollers, characterized in that lamellar ring (2) has at least one buckling point (4, 14).

2. A lamellar ring as recited in Claim 1, characterized in that the cross section is approximately Z-shaped.

3. A lamellar ring as recited in Claim 2, characterized in that the lamellar ring has two buckling points.

4. A lamellar ring as recited in one of the Claims 2 or 3, characterized in that the rib has parallel edges that include an angle to the axis.

5. A lamellar ring as recited in one of the Claims 2 or 3, characterized in that the rib expands toward the axis.

6. A lamellar ring as recited in one of the Claims 1 through 5, characterized in that lamellar ring (2) is made of rubber, natural rubber, plastic, or the like.

7. A lamellar ring as recited in one of the Claims 1 through 6, characterized in that, when a radial pressure is applied, the outer circumference is shifted axially (dli), with cylindrical surface (20) maintaining parallelism with the axis of the roller.

8. A device for guiding web-like materials, such as paper, textile, or film webs, having at least one roller core and lamellar rings arranged on it, in particular as recited in one of the Claims 1 through 7, which are preferably arranged symmetrically to the axial central plane of the roller core, characterized in that rings (2) form a virtually closed surface, whereby when a radial pressure is applied, e.g. by the tension of the material web running over it, the outer circumference is displaced axially (dli) and symmetrically to the axial central plane and cylindrical surface (20) maintains parallelism with the roller axis.

9. A device as recited in Claim 8, characterized in that the individual lamellar rings (2), from the central plane to the right and left, have different Shore hardness values.

10. A device as recited in Claim 9, characterized in that the Shore hardness values decrease toward the outside.

11. A device as recited in one of the Claims 8 through 10, characterized in that the surface of the roller, which is made of lamellar rings (2), is provided with a smooth, flexible covering (3).

12. A device as recited in Claim 11, characterized in that flexible covering (3) is tubular.

13. A device as recited in Claim 11 or 12, characterized in that flexible covering (3) is provided with inwardly pointing projections (10), which engage in intermediate spaces (9) between lamellar rings (2).

14. A device as recited in Claim 13, characterized in that projections (10) are symmetrical to the axial central plane of roller core (1).

15. A device as recited in one of the Claims 13 through 14, characterized in that projection (11) lying in the axial central plane is in itself symmetrical.

16. A device as recited in one of the Claims 8 through 15, characterized in that two rollers are present, rotating in the opposite sense with lamellar rings (2) and flexible coating (3) having a smooth surface, which are pressed against each other.

17. A device as recited in one of the Claims 8 through 16, characterized in that flexible coating (3) is made of rubber, natural rubber, or the like.

18. A method of producing a device as recited in one of the Claims 8 through 17, characterized in that flexible coating (3) is affixed to the ends of a pipe (15) and pressed against the inside of pipe (15) by the application of pressure or vacuum.

19. A method as recited in Claim 18, characterized in that a roller core (1) provided with lamellar rings (2), in particular as

recited in Claim 1 or 2, is inserted in the axial direction into and positioned in flexible coating (3).

20. A method as recited in Claim 19, characterized in that the pressure or vacuum is turned off and the roller, provided with flexible coating (3), is removed from pipe (15).

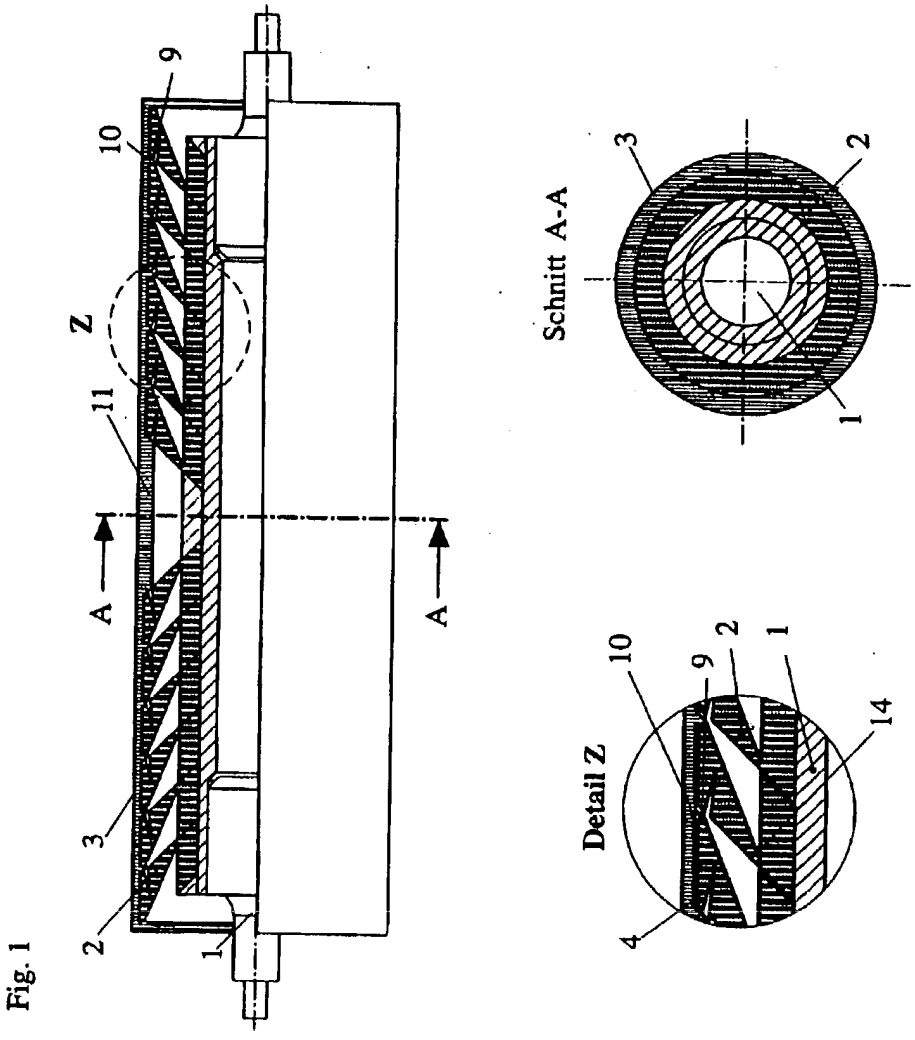

Fig. 1

Schnitt = Section

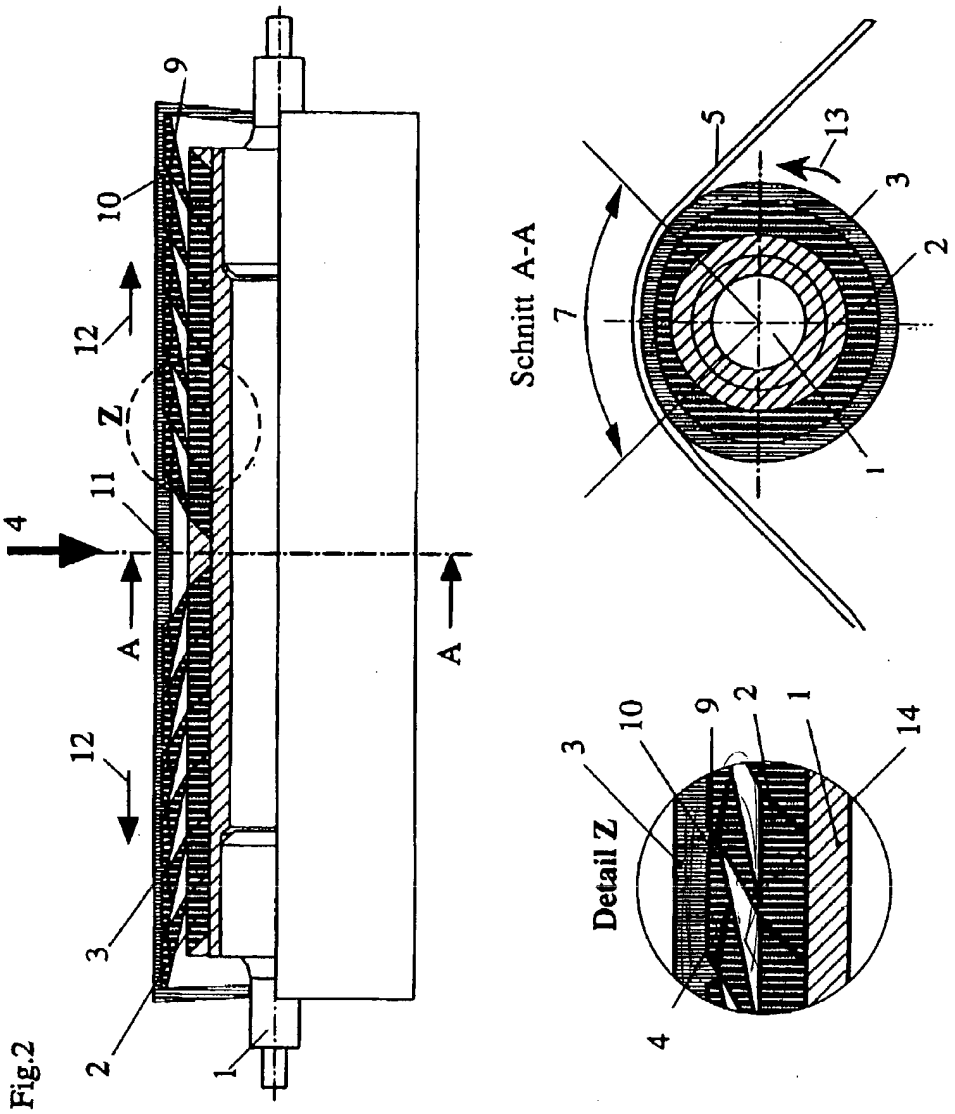

Fig.2

Schnitt = Section

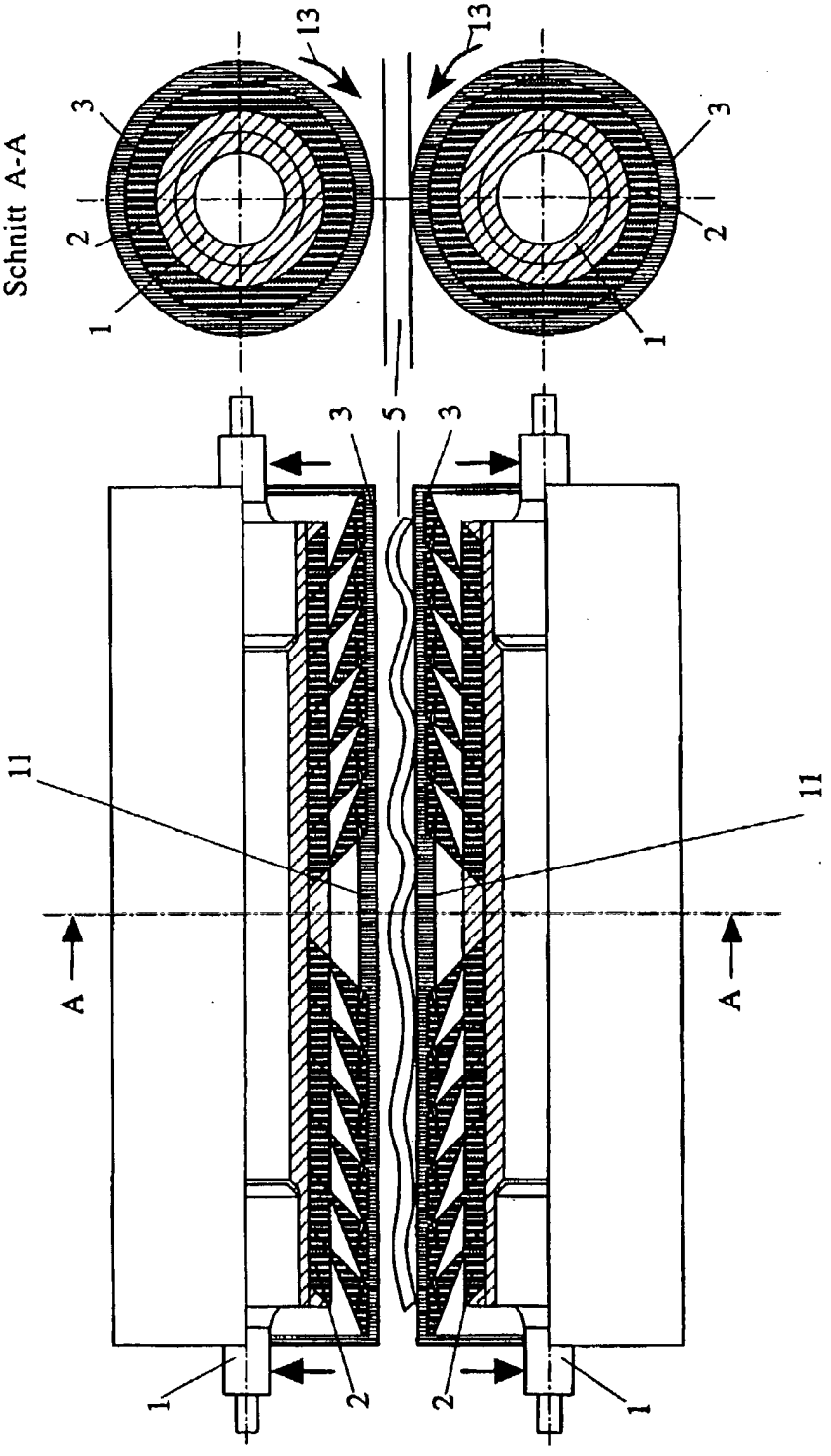

Fig. 3

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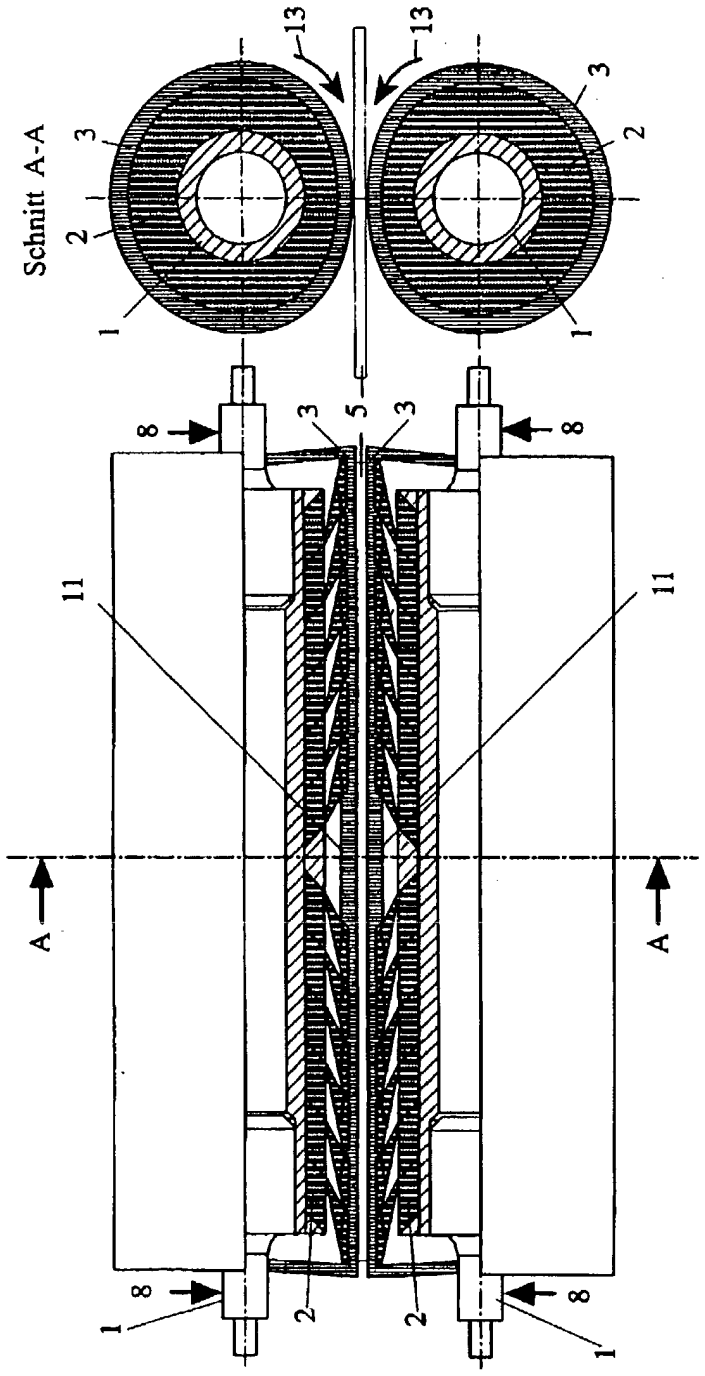
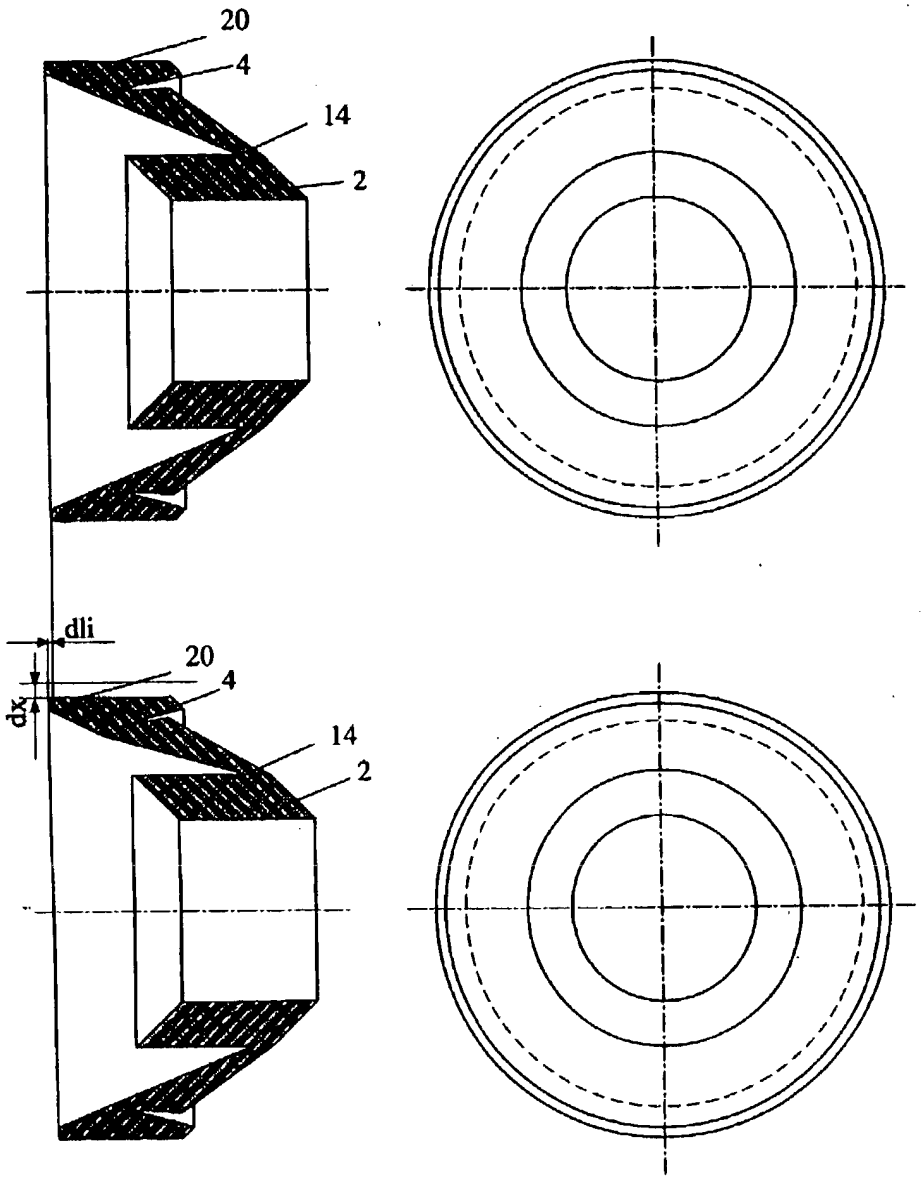


Fig. 4

Schnitt = Section

Fig. 5



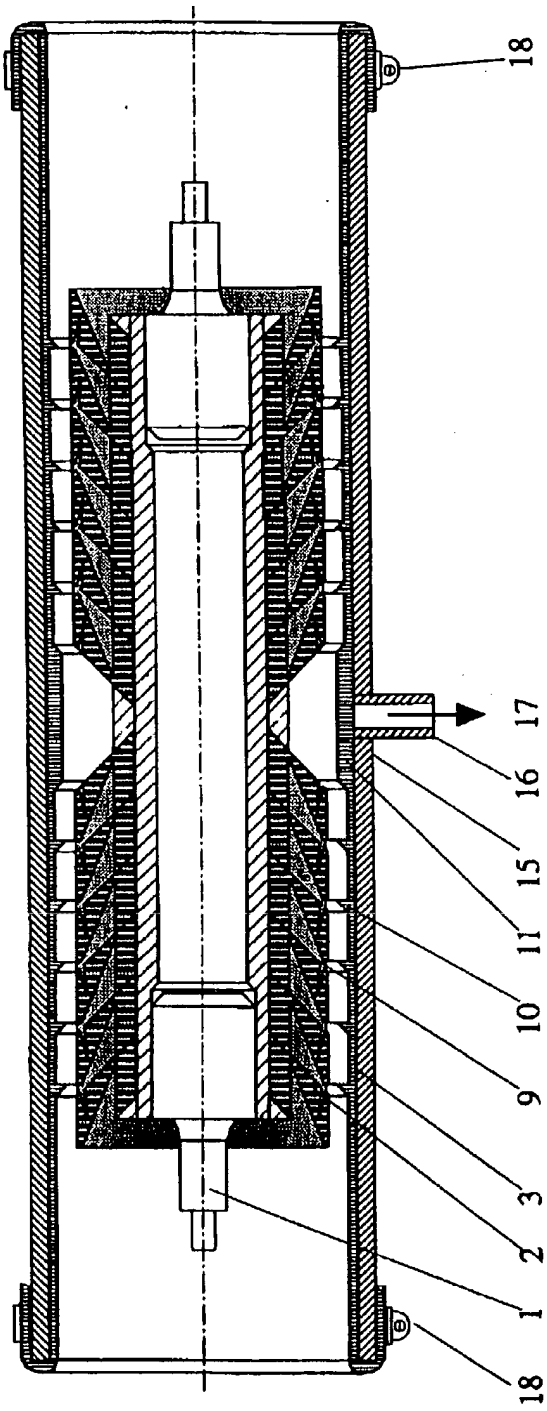


Fig. 5a

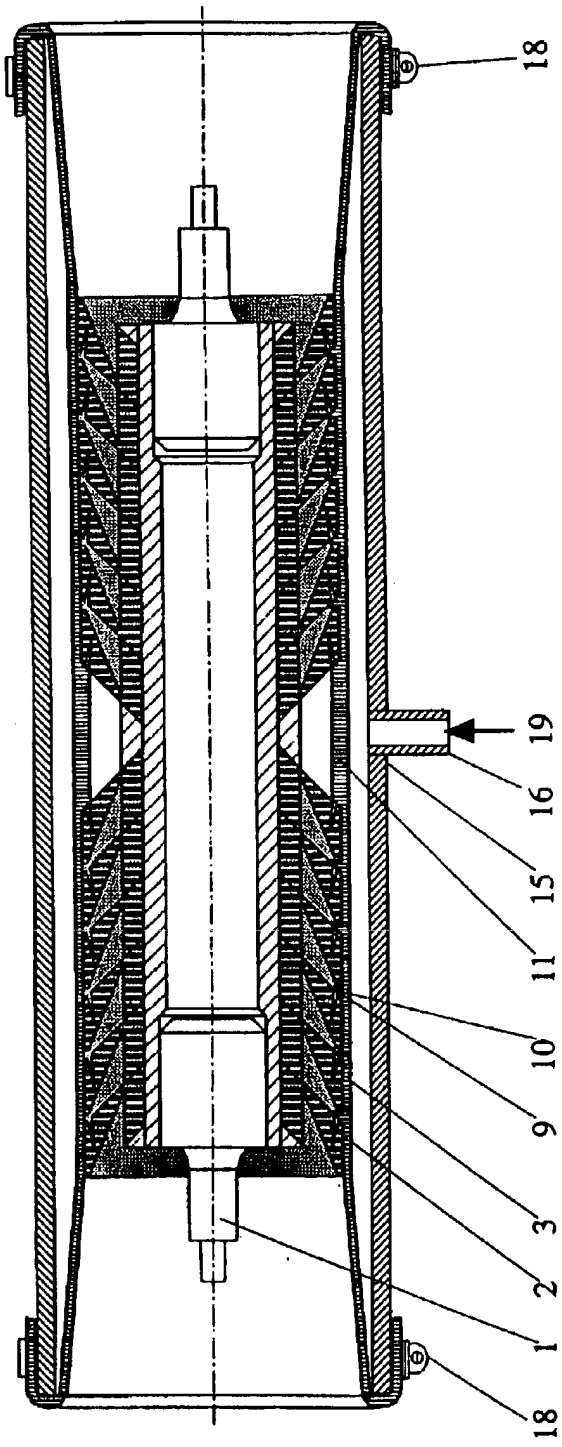


Fig. 5b

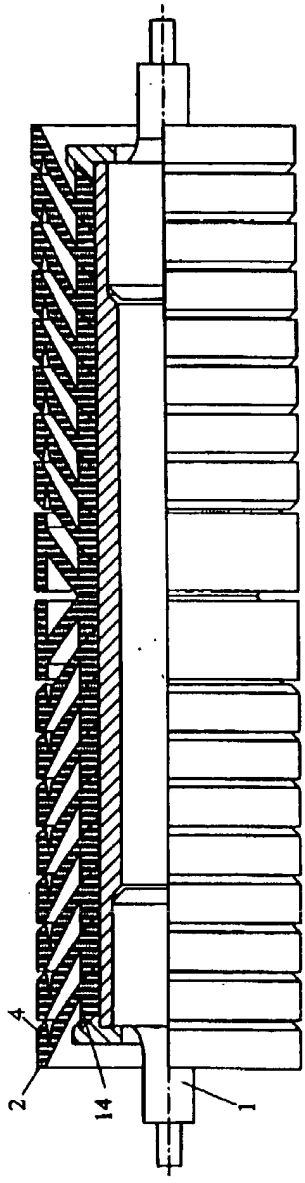


Fig.6

Fig. 7a

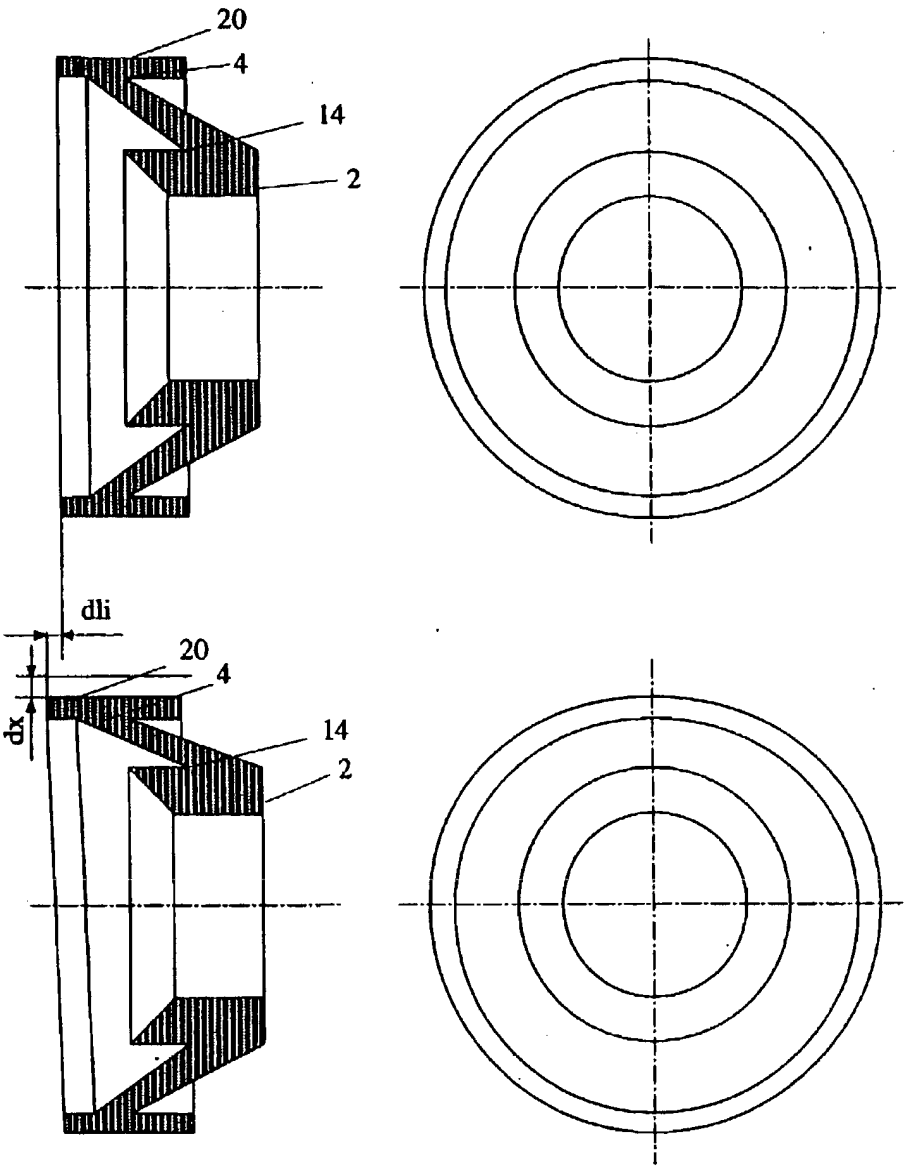


Fig. 7b .